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ABSTRACT

Using game theory as a model, suggestions are made to improve tenured public school teachers' individualized professional improvement plans. Seven basic concepts are discussed: (1) the game concept, a situation which involves decision making by the participants; (2) strategy--a plan for behavior under varied circumstances; (3) payoff--the value of an action; (4) rules--directions which structure the game; (5) information--the data available; (6) coalition--the temporary alliance among some players; and (7) timing--the choice of when a strategy will be implemented. Based on the assumption that administrator--teacher conflict is present in in-service education, the concept of payoff is discussed. Four types of payoffs are associated with teachers' workshops: reward for attendance; penalties for absence; temptation for defecting from the cooperative position; and sustaining the attending and cooperating position. Payoff charts for conflict situations are used to provide insights related to rational decision making; to emphasize key elements; and to encourage recognition of the dilemma between individual and group needs, and of the need for solutions. It is suggested that the current workshop game which teachers and administrators play must be reconceptualized: they must work cooperatively on a teacher improvement plan. Supervisors should implement a new payoff chart and demonstrate leadership by rewarding teacher improvement. (MH)

USING INSIGHTS FROM GAME THEORY IN EVALUATING TENURED TEACHERS

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The baseball season began earlier this month and it will end sometime in September when a new game, so to speak, will begin for New Jersey educators. As of September 1 school districts will begin their annual evaluation of tenured teachers as mandated by the state board of education. The state board is, I believe, reacting to pressure from society which is unhappy about many elements in our lives. (When things go wrong in our society--whether we're losing the space race to the Russians or losing the urban middle class to the suburbs--the schools are the whipping boy.) In this paper I shall look at one aspect of in-service teacher improvement from the vantage point of game theory because I believe we can glean some insights to use in preparing individualized professional improvement plans which are prescribed as part of the written annual evaluation report for each New Jersey tenured teacher.

What Game Theory Is[1]

Game theory derives from the now classical book by John von Neumann and Oskar Morgenstern in 1944, Theory of Games and Economic Behavior. Its original purpose was to provide a new approach to examining economic problems. In the last few years the use of game theory has spread to other social sciences such as sociology, political science, and psychology. Game theory deals with conflict situations where rational people try to maximize their gains and minimize their losses. Game theory is a scheme for analyzing situations where people with different interests who can make alternative choices affecting the outcome of the situation are rational and informed. In this way it is a model for describing and predicting behavior given the conditions specified by the model.

Game theory is closely associated with games of strategy such as chess, checkers, and tic-tac-toe. This is so because the pattern of rational behavior is the same in these games of strategy as in social conflict situations that demand rationality--achievement of goals at the minimum cost under specified conditions. In these games, as opposed to games of chance such as craps and roulette, several key elements are present: (1) players are rational in respect to making moves; (2) there are conflicts of interest since a win by one player necessitates a loss by the other; (3) a number of alternative moves are available; and (4) players can estimate the consequences of their moves, recognizing that important consequences are a result of their own moves and the moves of the other players over whom they have no control. It is because of this close association with games of strategy that game theory has the name it has despite the fact that it originated as a mathematical approach to economics.

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There are seven fundamental concepts of game theory which deserve attention as we look at conflict situations. (These are in addition to such common game terms as players, moves, competition, win, lose, and goals.) First and foremost is the concept of game. A game is a situation which involves decision making by a player or players with certain goals in mind. As a result of the decisions (that is, moves) of the players--and also possibly as a result of chance--there is an outcome or outcomes for the players in the form of a reward or punishment. In a game each player maintains rational control over personal moves. It is obvious that such a concept of game is not frivolous nor does it imply only such recreation activities as chess, bridge, poker, and golf. According to this concept, there are conflict situations in real life in such areas as politics, business, law, education, personal affairs, and war which we can call games.

This concept of game appears in the popular psychology of Eric Berne, Games People Play: A Psychology of Human Relationships and Thomas Harris, I'm OK, You're OK: A Practical Guide to Transactional Analysis. These psychologists apply the concept of game to daily interaction among people. The game offers an easily comprehended and accessible analogy. There are obvious and useful parallels between the competition and aggression found in games and that found often in other aspects of human interaction.

The psychologists label the various patterns of interpersonal conflict behavior which emerge among people as games and interpret the actions as well as the results for their clients and readers. With the familiar concept of game to build upon they are able to bring psychological insights to people who wish to understand and thereby improve their interpersonal behavior. These psychologists, however, do not quantify the consequences of an individual's alternative behavior as do the game theorists. The game, for these psychologists, is a model, a springboard, for psychological insight and self-improvement.

The second concept in game theory is strategy. Strategy is a complete description of how a player will behave under every possible circumstance. (Note that in game theory language "player" is equal to decision maker and can refer to a single person, a team, a corporation, a state, or any unit of people acting together with the same interest.) Strategy thus refers to the set of moves that a player makes so as to achieve a goal. Strategy takes into account what the other player will do. That is, if I make move A, then my opponent will make move B, and then I will make move C.

In game theory the best strategy is the one that will permit a player to win or to gain self-protection from whatever the opponent can do. The basis of calculations in determining which of several strategies to take is the assumption by a player that the opponent is not only rational but as quick witted and sharp as the rules permit. A player who believes that the opponent is not rational and whose strategy relies on nonrational moves from the opponent suffers in game theory.

The third basic concept is payoff. Payoff refers to the value of a given move as it coincides with an opponent's move. Let us assume that two players, Pat and Chris, each have two possible moves, A and B. There are then four possible combinations of moves: AA, AB, BA, BB. For each of these 4 combinations there is a payoff for Pat and a payoff for Chris. The payoffs may or may not be the same. Thus, for example, if Pat moves A and Chris moves A, the payoffs might be 2 and 2, or 2 and 3, or 7 and 2, depending on the situation specified, or any other set of values.

In game theory the payoffs appear in mathematical terms so as to ascertain readily which payoff is preferred over the others. The list of payoffs for each player according to the various combinations of moves is called the payoff matrix or payoff chart. In social situations it is difficult to assign numerical values to each combination of moves but it often is necessary so as to facilitate the analysis of the conflict situation. For without numerical values and only with ordinary language it is sometimes impossible or at least hazardous to determine which combination of moves is preferred.

The fourth concept is rules. In every game there are rules which direct the players in making their moves. The rules structure the game; without rules there is no game. In game theory it is necessary to carefully specify the rules so that each player can clearly know them and thus move rationally according to them. In parlor and athletic games it is easy to locate and specify the rules of the game. However, in social, political, economic, or psychological conflict situations it is not easy to ascertain all the rules directing the moves of the players. Yet, if we are to analyze social conflict situations we must attempt to ascertain the existing rules since they affect the determination of strategy. To understand the other players in the conflict we need to know by which rules they operate. For example, the Israelis must determine what rules the Egyptians live by if they are to determine their own policy regarding peace negotiations.

The fifth concept is information. In every game certain information is available to the players. In chess each player has equal and complete access to information about the game. Chess is thus a perfect information game. Not all games are perfect information games, however. Bridge, for example, is not a perfect information game since each player knows which cards are personally held but does not reveal them to the opponents. In social conflict situations it is not possible to have a perfect information game. In large scale situations players often resort to spying in order to increase their information so as to better determine their strategy. Thus, the U.S.A. had spies in Germany in the 1940's in order to find out the location of airplane and V-2 rocket factories so that it could plan bombing raids successfully.

The sixth concept is coalition. This concept is important in games where there are more than two players. In games of 3 players or more, two players can agree to cooperate as a means of defeating a particular player. When the coalitionists win, they share the payoff, equally or unequally as influenced by the strength of each player. Coalitions are temporary and subject to dramatic change. Change often comes about due to a double-cross by one of the coalitionists. Though there may be temptation to double-cross a fellow coalitionist, the risk of retribution is also high. Players who are double-crossed often seek revenge on the violators of the coalition because the loss of the payoff as well as the sting of loss of face hurts.

The seventh concept is timing. The importance of timing arises from the recognition that players have imperfect information as they plan strategies and coalitions. When a player makes a certain move, it is significant because the effect of any given move must be seen in light of the information as opponent has at that moment. There is a time context for each move a player makes, and this context is one which the player must carefully consider.

Types of Games

The most popular of the games people know is the two-player zero-sum game. In this game two players oppose each other with each aiming to win the game. If one wins, then of necessity one player loses. This is called a zero-sum game because the players' interests are diametrically opposite and the sum total of wins is always zero since a loss is considered a negative win. For example, in chess, baseball, basketball, tennis, and gin rummy there is always one winner and one loser. The zero-sum game, especially the perfect information game of which chess is the prime example, has had the attention of many analysts because it is possible to work out strategies, rules, and payoff charts with precision.

Another type of game is the two-player nonzero-sum game. In this game the total of wins does not equal zero since the interests of the players are not diametrically opposite. In the nonzero-sum game there are elements of competition and cooperation between the two players. The gain of one player is not necessarily the loss of the other since in a given outcome both players can benefit though in varying amounts. Most social conflict games are nonzero-sum games. For example, if we view the business world from a game theory perspective, we see that two competing soap companies can both lose money if they both engage in costly advertising campaigns. On the other hand, if they cooperate the two companies can each increase profits. Similarly, in politics the gain in public esteem of one politician need not come at the expense of another. It is possible for two rival politicians to increase their rapport with their public simultaneously. It is significant to note that although most social-conflict games are not inherently zero-zum games, they are played as if they are. I shall comment on this again later.

The difference between these two types of games, zero-sum and nonzero-sum, is enormous. It is the difference between opposite interests and mixed interests, where one involves only competition, the other involves elements of competition and cooperation. If we view the interaction between the U.S.A. and Russia on nuclear arms limitations as a zero-zum game rather than a nonzero-sum game, we surely will arrive at a view which depicts Russia as our enemy and not as a partner in peaceful preservation of the world.

Applying Game Theory to Teacher Education

Let us now look at teacher education using these game theory concepts--game, strategy, payoff, rules, information, coalition, timing, players, moves, competition, win, lose, and goals. To focus our analysis we shall concentrate on the concept of payoff. First, however, there is the need to show that a conflict exists in in-service education so as to justify applying these concepts in the first place.

When we look for conflict, we see several areas not just one. There is the conflict between administrators and teachers regarding in-service activities. Anyone who has ever conducted an in-service workshop or given a lecture in a school on a professional day for teachers bears witness to the resistance teachers show to attending, let alone to cooperating. Administrators want

their teachers to attend the workshop but the teachers often resist, and therein exists one source of conflict in the school.

Conflict also often exists between administrators and teachers regarding the direction and goals of the school. Sometimes an administrator wishes to introduce a new program only to find the teachers resistant to change, subtly and not so subtly refusing to leave the old for the adventurous new. Sometimes a teacher, having picked up a new idea at a conference or convention or university class, wishes to venture out into a fresh area but finds an administrator who resists by not offering financial or educational support. In either case, a stalemate results as each side becomes the proverbial immovable object.

We can now look at one specific game played in in-service education. I shall call this game the Workshop Game.[2] Here the administrator sets up a workshop for the teachers to attend in order to learn the necessary skills and knowledge to implement a new program in the school. The administrator expects every teacher to attend, and every teacher knows this. The teachers, therefore, begin to consider whether or not to attend. They ask, "What is the utility of not attending the workshop and/or not cooperating with the workshop leader? They know what the payoffs for their moves are from their past experience or they learn from a vocal colleague.

There's a plus and a minus for attending and cooperating just as there is for a plus and minus for not attending and/or not cooperating. The teachers know that if they attend and cooperate they will learn some new skills and knowledge and at the same time become part of the school's mission by sharing in the feeling of camaraderie. Also, they will get involved in subsequent long and hard committee work and a threatening situation, which is unpleasant even though it will eventually lead to professional change and growth. The situation is threatening in that the teachers will feel the need for change as they become challenged in regard to their current program and behavior. They also know what will happen if only a few attend while others stay away from the workshop. The ones who do attend will bear the brunt of needed committee work as well as harboring anger because those who do not attend will appear to benefit by having more free time.

There is also a plus and minus for a teacher who does not attend and/or cooperate. The plus includes (1) free time; (2) not being put on the defensive during the workshop by questions about the old program and ignorance of the new one; (3) not being put in the role of a student, a role a teacher usually doesn't like, vis à vis the workshop leader; and (4) avoidance of future committee work which is generally distasteful and time consuming. The minus is a function of all teachers making the same decision. If only one teacher "cuts" the workshop, to use the language of the schools, nothing much negative occurs overall to the school since the workshop will succeed in any case. However, if they all don't attend and/or cooperate, then (1) there will be no new program for the students; (2) the school loses its mission; and (3) there will be little professional change and growth (stagnation) for the teachers.

Any particular teacher only shares a fraction of this negative result, whereas for the positive one the teacher gains the full utility personally. In consideration of the two payoffs, a given teacher decides to stay away from

the workshop, either physically or mentally. But so does the next teacher, and the next, and the next until finally the workshop fails and the negative result occurs. At this point the new program does not become a part of the school and the entire school suffers, including, of course, the teachers who do not attend and/or cooperate.

This scenario for the Workshop Game is a familiar one. It bears a strong resemblance to the famous two person nonzero-sum game called the Prisoner's Dilemma. To best understand the Workshop Game it is worthwhile to briefly detour in order to inspect the payoff chart of the Prisoner's Dilemma. It will serve subsequently as an analogue for the payoff chart of the Workshop Game, and we can apply analyses common to it to teacher education. Briefly, in the Prisoner's Dilemma two prisoners are each asked separately to confess to a robbery reported to the police. Each is told that the penalty in terms of time in jail depends on his decision and the other's decision. Figure 1 shows the payoff chart for one version of the crime.

INSERT FIGURE 1

Now, since both prisoners are rational, each realizes that there is temptation for personal gain to confess and get the shortest sentence. Each also realizes that for self-protection it is necessary to confess because if not, it is possible to be stuck in jail for 3-5 years. This will happen if one prisoner confesses and one does not. So to minimize potential penalty, each confesses. The net result for each is a 2-3 year sentence which is longer than the sentence (1½ years) if both had trusted each other and not confessed. The dilemma arises in that each person acts in what appears to be individual self-interest and yet the result is worse for each. End of detour to get acquainted with the Prisoner's Dilemma.

When we put the payoffs of the previous scenario about the Workshop Game into a complete payoff chart similar to that of the Prisoner's Dilemma, we get the chart shown in Figure 2.

INSERT FIGURE 2

This payoff chart for the Workshop Game is the same in internal structure as that of the Prisoner's Dilemma. We can see this by identifying four types of specific payoffs within the chart. There is a payoff for each teacher when all attend and cooperate. Following the standard procedure in game theory we

label this particular payoff "R," which derives from reward for mutual cooperation. There is a particular payoff when all do not attend and/or do not cooperate. We label this payoff "P," which derives from penalty for double defection from the cooperative position. There are payoffs when one teacher does not attend and/or does not cooperate and the others do attend and cooperate. The particular payoff for the defector we label "T," which derives from temptation for defecting from the cooperative position. The particular payoff for those who do attend and cooperate we label "S," which derives from sustaining the cooperative position.

When we look at all four particular payoffs together we see that in the Workshop Game, as in the Prisoner's Dilemma, we can write an inequality by using the symbol ">" to mean "better than." Thus we have T > R > P > S. This means that the temptation payoff is better than the reward payoff which is better than the penalty payoff which is better than the sustaining payoff. Now that we've established that this inequality exists and that it is the same for the Workshop Game as for the Prisoner's Dilemma we are in a position to make several fruitful and insightful comments about the Workshop Game.

First and foremost we see that such a payoff chart leads the teacher not to attend and/or cooperate with colleagues and the workshop leader. The teacher recognizes that at least in the short run the payoff for individual self-interest (T) is the best one. Thus the teacher defects for it. Other teachers see that for self-protection they, too, must defect. This is so because the payoff for attending and cooperating when others don't (S) is not as good as the one for double defection (P). So, to maximize potential payoff outcome knowing that P > S each teacher defects (that is, doesn't attend and/or doesn't cooperate). The teacher does so in order to avoid the undesirable role of the martyr who suffers at the hands of the original defector.

Such reasoning shows that when each teacher acts in what appears to constitute each's own best self-interest, the payoff is not as good as when teachers cooperate with each other. Indeed, this is the dilemma facing teachers in in-service education. Nicholson, in his examination of this type of dilemma, states that such reasoning in conflict situations goes counter to our first impressions but nevertheless holds true. He puts it this way:

> Individual rationality in this case does not lead to social rationality, which is a disturbing conclusion and violates many intuitive preconceptions of the consequences of individual rational conduct. Intuitively one feels that, if everyone is motivated only by his individual self-interest and acts according to some precepts of rational conduct, then either all, or at least some, of the actors should be better off. However, this case shows that this is not true. Two people acting according to rules of individual self interest both fail to achieve as much according to this criterion as if they had violated such rules.[3]

This dilemma and its reasoning are not unique to teacher education for we have the same one in our judicial system, and it leads to witnesses confessing, turning state's evidence, and plea bargaining for lighter sentences.

Politicians use similar reasoning in the dilemmas they face in regard to nuclear disarmament, for example. Game theory as a model allows us to identify these similarities and note that all people try to set their goals down in understandable form, delineate the choices available to them, predict the probable consequences of each decision, and assess the value of each of the possible outcomes.

What Snyder says about the commonality between political scientists who examine conflict situations and game theorists applies to educators as well who study conflicts in education:

> Both aim to reduce a series of social actions and a wide variety of human behaviors to some sort of order. Both are confronted by complexity of phenomena . . . All must select and interpret data from a large body of seemingly undifferentiated events and conditions concerning which knowledge is rarely complete. The central bond between the game theorist and the student of politics is the common interest in decisions, decision-making, and conflict. All policy-makers must sooner or later try to select a successive course of action from among alternatives. This involves a prediction of consequences based on assessed probabilities.[4]

Second, the use of a payoff chart directs us to focus on key elements of a conflict situation. We immediately begin to seek answers to: What are the players' goals? What do the players know? What moves can the players make? What are the consequences of each available move? What are the rewards and punishments (gains and losses) for the possible outcomes? In seeking these answers we clarify our understanding of the conflict situation so that we can explain it to others and have a conceptual springboard for setting up a more desirable payoff chart. (I shall present two possible more desirable charts shortly.)

Third, as we further examine the Workshop Game's payoff chart, we see that it presents a nonzero-sum game rather than a zero-sum game. That is, the Workshop Game is essentially different from basketball, chess, and poker. The game is not one of wins and losses; it is not a black and white situation as in a zero-sum game. Rather, it is possible for players to do well together, to have mutual interests. The nonzero-sum game gives rise to the dilemma between individual rationality and social rationality. The recognition of this dilemma indicates why teachers of good will interested in their own professional welfare often do themselves, their schools, and their students a disservice in the long run. This is disturbing but enlightening.

Once we realize that we are in a nonzero-sum game, then it behooves us to act accordingly. A wrong or distorted perspective leads to inappropriate action. Remember what action Machiavelli prescribed for his prince because his concept of power involves a zero-sum model rather than a nonzero-sum model. That is to say, for Machiavelli a prince who increases his own power diminishes the power of another prince and vice versa. In short, secrecy, bluffing, defection, and strict competition which are appropriate to a zero-sum game are inappropriate and perhaps disastrous in a nonzero game. Unfortunately, there is a tendency to

see things in Machiavellian, zero-sum terms, even when these terms are inappropriate or even actually destructive.

Fourth, by focusing on the payoff chart of the Workshop Game and on its dilemma we begin to recognize the need for concerned teachers to set up a series of small situations which will lead ultimately to opting for social rationality. These will increase the probability--habit, if you will--that those involved in larger conflict situations will cooperate with each other for long run mutual benefit rather than short run individual benefit. Not only do teachers need experience in opting for social rationality but also rules which will guide their actions. These rules help to lock us into collective rationality for mutual, long term benefit so that we need not ponder the conflict each time in order to decide which move to make.

Fifth, this look at the payoff chart directs us to look at patterns of interaction among players of a game rather than the intentions of the players. It is instructive for both an analyst and a decision maker to ask "What did Teacher Jones do when Teacher Smith made move A?" and "What was the payoff for the teachers when Jones responded with move B to Smith's move A?" Such questions are more helpful than the common question, "What did Smith intend by move A?" This is in line with the famous story about Napoleon who is said to have directed his generals not to consider intentions of the enemy but their capabilities as they planned their own moves.

Beyond Understanding and Into Change

In his gem of a book, Process Consultation: Its Role in Organization Development Schein builds on a key assumption, namely that "managers often do not know what is wrong and need special help in diagnosing what their problems actually are."[5] The task of the process consultant is to help managers diagnose their situations. I submit that the in-service educator functions as a process consultant and therefore has the task of helping teachers see in an insightful way those "human processes which occur" in their school. Moreover, the in-service educator has the task of guiding teachers to find possible alternatives to the current situation causing difficulties.

I shall cite only two facts to demonstrate that there is an urgent need to alter the current situation. First, in a recent survey of teachers 86% reported that they are dissatisfied with in-service education today.[6] Nevertheless, in-service education is the primary avenue for us to use if we wish to reach today's teachers. In the State of N.Y., which I believe is not different from other states, 84.6% of the teachers by 1976-77 held permanent certification.[7] This means that these teachers had no legal need to return to university classes for further study.

With this situation in mind let me present two essential tasks of in-service educators once they understand the nature of the Workshop Game as diagnosed above. The first task is to identify the Workshop Game to teachers and to lead them in a diagnosis of the consequences involved in playing that game with the payoff chart as it is now constituted. This is a delicate task but not a difficult or impossible one. It does, however, require knowledge and tact.

With opportune discussions it surely is within the reach of in-service educators to succeed in helping teachers understand the game they are playing.

The second task, the crucial one, is working with teachers to enter into playing a new game. By new game I mean the Workshop Game with a different payoff chart which will lead the teachers to decisions congruent with the improvement of teaching via social rationality. This necessitates that the in-service educator have in mind some payoff possibilities to offer teachers and to discuss with them as a way of beginning that new game. Let me suggest two possible payoff charts which I believe are preferable to the current one suggested earlier. Both are preferable to the current Workshop Game because they lead teachers to choose more desirable payoffs.

The first payoff chart appears in Figure 3.

INSERT FIGURE 3

Note that in this new game we build on the old one and change the inequality among the four payoffs. Here we have $R > S > P > T$ rather than $T > R > P > S$. This new inequality is achieved by bolstering the rewards for cooperating with other teachers since we have added two more positive elements: (1) approbation of the professional and lay communities; and (2) many credits toward a pay increment. We also make the temptation to defect (T) most unappealing. Thus the reward for cooperation (R) is the best payoff. Moreover, even if someone defects, the teacher who sustains cooperation still receives a good payoff (S) which is the next best payoff.

We can call this payoff chart the Idealist/Fool chart for the person who defects would be a fool to do so. The person who cooperates initially and then sustains that position by attending and cooperating with colleagues is an educational idealist deserving of high compensation. By changing the payoff inequality we lead teachers to make a decision which is cooperative. This is what makes this payoff chart prefereable to the one for the current Workshop Game.

The second possible new game has a related but different payoff chart. This payoff chart appears in Figure 4.

INSERT FIGURE 4

In this payoff chart we also build on the current one but change around the cooperating and defecting moves. That is, here we admit that teachers who cooperate do so in a current situation which is undesirable. Furthermore, we wish to lead them from such a payoff.

To accomplish this we make the inequality here T > P > R > S. We make the temptation to defect so appealing that a teacher will opt for it (T). In so doing the teacher will entice other teachers to defect also since the payoff for double defection (P) is still better than R and S. We actually lure everybody to defect and we are pleased because P is quite desirable. Though P is not as good as T, it is better than R and S. Note that R here is equal to the T of the current Workshop Game shown in Figure 2.

Thus we can call this game the Leader/Follower game. The leader is willing to try something new and desirable and is willing for other teachers to follow suit. In effect the leader says, "I'm going to change because the payoff is very good. If you don't follow me, you'll suffer the consequences of stagnation. If you do follow me, we'll all be better off and that's just fine with me. I'd prefer that you follow me but even if you don't I'm changing anyhow." This is what makes this payoff chart also preferable to the one for the current Workshop Game.

Implementing Change for New Jersey's Tenured Teachers

The question now is, "How can we change the current Workshop Game so that we can implement one of the two new payoff charts or some other one which will lead to teacher improvement? My brief answer is "By prevailing upon teachers and supervisors--whether department chairpersons as supervisors or building principals as supervisors--that there is a genuine need for change and adventurous risk taking. We have created the current Workshop Game, and therefore we can revise it. It is not part of nature like the unmovable mountains and the deep oceans."

Let me re-state emphatically that the first step toward revision is reconceptualization. The result of this step, a revised payoff chart as I have suggested earlier, may be enough when presented to teachers to lead them to change. The power of reconceptualizing a problem is brought home to me by Ryle's[8] analysis of the classic Greek paradox of Achilles and the tortoise, as formulated by Zeno. Let me remind you about this paradox. Achilles is chasing the tortoise. "Achilles is in pursuit of the tortoise and before he catches him he has to reach the tortoise's starting-line, by which time the tortoise has advanced a little way ahead of this line. So achilles has now to make up this new, reduced lead and does so; but by the time he has done this, the tortoise has once again got a little bit further ahead."[9] Thus there always remains something for Achilles to make up, and the tortoise is always ahead of Achilles.

This paradox is well known and had puzzled me for years because I couldn't figure out why the speedy Achilles doesn't catch the slow tortoise. Zeno had created a mental box for me, so to speak, and I couldn't get out of his box. I was trapped into thinking the way Zeno had led me to think, and so I never was able to resolve the paradox posed: Achilles catches the tortoise according to common sense and experience but does not catch the tortoise according to Zeno's formulation. Only through the reconceptualization offered by Ryle was I able to get out of the box I was in. I had to see the problem differently and then I was able to solve the problem. I shall not attempt to paraphrase Ryle's

solution for you because that would be a digression from my point, which is the need for and power of seeking a new way to look at a problem. For Ryle's complex and illuminating solution I refer you to his book Dilemmas.[10]

As I see it, then, once we are aware of some alternatives to the current Workshop Game, and I have offered two possible alternative payoff charts, the second step for bringing about change is the individualized professional improvement plan which the teacher and supervisor must develop together. The preparation of an improvement plan is prescribed by Administrative Code — 6:3-1.21 which mandates the annual evaluation of tenured teachers in the first place. Here is the opportunity for the supervisor (the Administrative Code uses the generic term "supervisor" for all those who write evaluation reports) to make suggestions and take a stand for a changed payoff chart for the Workshop Game. (I continue to focus on the Workshop Game because in-service education is and I believe will continue to be the primary means for helping teachers to develop their professional skills. I recognize that there are other approaches to teacher improvement, and what I say regarding the utilization of the individualized professional improvement plan for changing the current Workshop Game could probably apply also to these other approaches.)

In developing the improvement plan the supervisor has the opportunity not only to make suggestions but also to explain how the rewards in the system can and will change. The supervisor can and should discuss the rewards with the teacher, always making sure that the rewards for cooperation and improvement are more favorable than those for resistance and stagnation. If necessary, the supervisor and teacher must work together to influence other people, professional and lay, to change the rewards over which the two of them have no immediate control. For example, if necessary, the supervisor and teacher should campaign for bringing pay increments to the teachers who successfully complete a specified series of workshops and demonstrate the implementation of change in their interaction with students.

I am not proposing threat, bribery, or manipulation. I am proposing leadership; I am strongly advocating that supervisors become instructional leaders by sincerely carrying out the task assigned to them by the Administrative Code. Yes, let the supervisors reward tenured teachers who improve. Let them specify in the improvement plan how they want their teachers to act and let them equally specify what the rewards are according to a reconceptualized payoff chart. Let them be explicit and firm. Let them take a stand leading to and supporting change.

We each already know enough about human action to realize that people respond positively to rewards. But, if you want to read research on the effect of rewards on teachers, I refer you to the research of Stephens[11] who shows that innovative teaching practices are related to the reward system in schools. According to Stephens, in discussing his research, "the results indicate that the crucial variable associated with innovative classroom behavior is the reward system as perceived by the teacher. This factor is related to teacher behavior more strongly than perceived norms or even one's own attitude about rewards and norms.... In conclusion, it can be said that, regardless of own attitudes and perceptions of norms, innovative teaching was related to the reward system in the schools studied here."[12]

New Jersey educators have before them the fresh possibility for improving their schools. They must become part of the solution rather than remain as part

of the problem for maintaining the current Workshop Game. Implementing a new payoff chart may be difficult, I admit, because many people believe that the current Workshop Game benefits them, at least in the short run. Though we have formulated the current payoff chart, it may be a trying task to create a mind set capable of welcoming its demise.

We need conviction and perseverance regarding teacher improvement, and the insights from game theory can guide our thinking and action. Let us employ the concepts of game, strategy, rules, information, coalition, timing, players, moves, goals, competition, and particularly payoff, the concept focused on in the paper. Let us talk about teacher improvement and show that it is a non-zero sum game requiring cooperation. We may not be able to complete the task of implementing a new Workshop Game, but, as the Talmud wisely reminds us, we must not desist from beginning our mission and striving toward its completion.[13]

References

1. For this paper I shall draw heavily on Chapter 7, "Using Game Theory for Conflict Analysis" of my new book Simulation Gaming for Values Education: The Prisoner's Dilemma (Washington, D.C.: University Press of America, 1978).

2. This Workshop Game, as described here, resembles the game presented by Garrett Hardin as "The Tragedy of the Commons" referring to the game herdsmen play in keeping their cattle on a public pasture (See Science, Vol. 162, Dec. 13, 1968, pp. 1243-1248).

3. Michael Nicholson, Conflict Analysis (New York: Barnes and Noble, 1970) p. 61.

4. Richard C. Snyder, "Game Theory and the Analysis of Political Behavior," reprinted in International Politics and Foreign Policy, ed. James N. Rosena (New York: The Free Press, 1968) p. 382, originally published in Research Frontiers in Politics and Government (Washington, D.C.: The Brookings Institution, 1955).

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6. Bruce R. Joyce, Kathleen R. McNair, Richard Diaz, and Michael McKibbin with Floyd D. Waterman and Michael G. Baker. Perceptions of Professionals and Policy Makers, Report #2 of the Inservice Teacher Education Concepts Project, National Center for Educational Statistics and Teacher Corps, Palo Alto, California, 1976.

7. Mike Van Ryn, "Inservice Teacher Education: A State Education Department Perspective." Paper presented at the 1978 meeting of the American Educational Research Association in Toronto, Canada, March 29, 1978.

8. Gilbert Ryle, Dilemmas (Cambridge: Cambridge University Press, 1954).

9. Ibid., p. 36.

10. Ibid.

11. T. Stephens, "Innovative Teaching Practices: Their Relation to System Norms and Rewards," Educational Administration Quarterly, 10, no. 1 (Winter, 1974), pp. 36-43.

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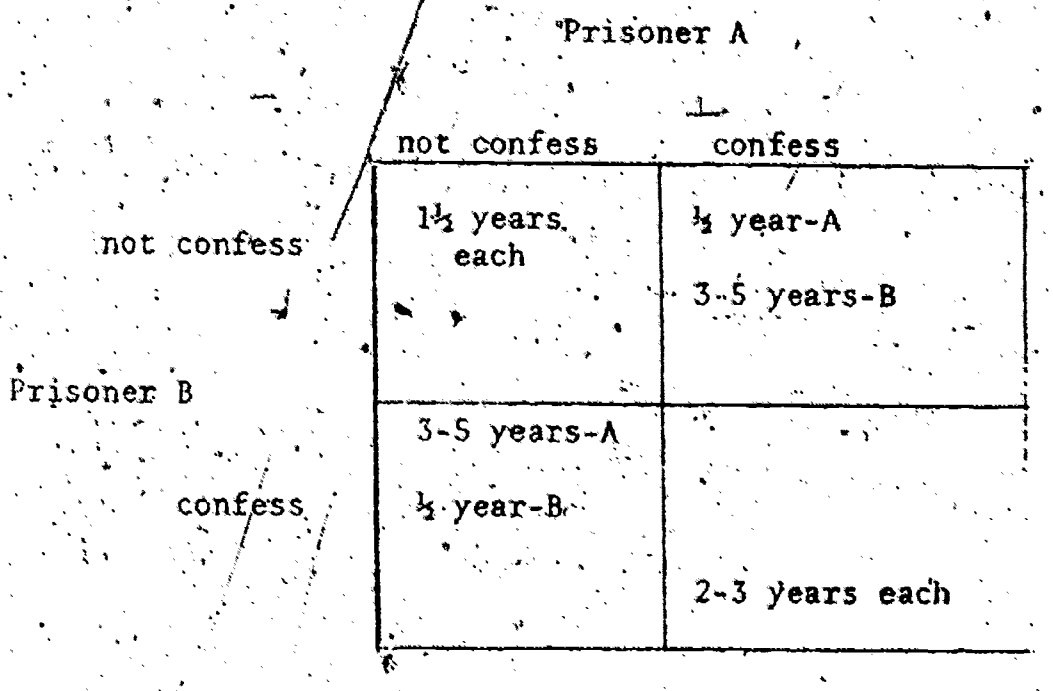
13. Ethics of Our Father, 2:21.



Payoff Chart for
the Prisoner's Dilemma for Time in Jail

Figure 1

Other Teachers \ Teacher A	Attend & Cooperate	Not Attend and/or Not Cooperate
Attend and Coop.	Hard and long committee work; Learn new skills & knowledge on curriculum & teaching; Common mission; camaraderie; Threat→need for change→growth: All Teachers	Free time; Not defensive in workshop; Not in position of being a student No Committee work: Teacher A Brunt of committee work & paper work; Threatened and changing; insecurity Angry about those who "get away with it" Feel like they're "meetinged" to exhaustion: OTHER TEACHERS
Not Attend and/or not Coop.	Brunt of committee work & paper work; Threatened & changing; insecurity Angry about those who "get away with it" Feel like they're "meetinged" to exhaustion: Teacher A	No new program for students; Missionless school; Little growth for teachers; stagnation; Few meetings as each teacher goes his own way: All Teachers
	Free time; Not defensive in workshop; Not in position of being a student No Committee Work: Other Teachers	

Payoff Chart for the Current Workshop Game

Figure 2

Other Teachers \ Teacher A	Attend and Cooperate	Not Attend and/or Not Cooperate
Attend and Coop.	Hard and long committee work; Learn new skills & knowledge on curriculum & teaching Common mission; camaraderie; Threat→need for change→ growth. Public approbation by prof. and lay communities; Many credits toward pay increment: All Teachers	Earn reputation as narrow and stagnated teacher; Loss of pay increment: Teacher A Hard and long com. work; Learn new skills & knowledge Common mission; camaraderie; Some self-questioning about attending; Some credits toward pay increment: Other Teachers
Not Attend and/or Not Coop.	Hard & long com. work; Learn new skills & knowledge; Common mission; camaraderie; Some self-questioning about attending; Some credits toward pay increment: Teacher A Earn reputation as narrow & stagnated teacher; Loss of pay increment: Other Teachers	Under pressure from peers, adm., & parents to change; Chastised by adm. & board of edu. with possible loss of pay increments: All Teachers

Payoff Chart A for a New Workshop Game

Figure 3

Teacher A

Other Teachers	Not Attend and/or Not Coop.	Attend and/or Coop. and Lead
Not Attend and/or Not Coop.	Free time; Not defensive in workshop; Not in position of being a student. No Committee work: All Teachers	Many credits toward pay increment Respect of adm., parents, & peers with public acknowledgment Leadership role among teachers as competent teacher; Small favors in school (e.g., room, equipment) Teacher A Looked down on by adm., peers, & parents as narrow & stagnated teacher; Loss of pay increment: Other Teachers
Attend and/or Coop. and Lead	Looked down on by adm.,peers, & parents as narrow & stagnated teacher; Loss of pay increment: Teacher A Many credits toward pay increment; Respect of adm., parents, & peers with public acknowledgment Leadership role among teachers as competent teacher; Small favors in school (e.g., room, equipment): Other Teachers	Some credits toward increment; Respect of adm.,parents, & peers with public acknowledgment Some committee work: All Teachers

Payoff Chart B for a New Workshop Game

Figure 4